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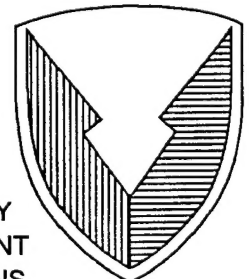
MULTIPLE LAUNCH ROCKET
SYSTEM (MLRS) ON
LOAD AND ROLL PALLET (LRP)
WITH SOFTWOOD DUNNAGE
TRANSPORTABILITY TESTS

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Prepared for:
Office of the Project Manager,
Ammunition Logistics
ATTN: AMCPM-AL
Picatinny Arsenal, NJ 07806-5000

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U.S. ARMY
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U.S. ARMY DEFENSE AMMUNITION
CENTER AND SCHOOL

VALIDATION ENGINEERING DIVISION
SAVANNA, ILLINOIS 61074-9639

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19. ABSTRACT (Continue on reverse if necessary and identify by block number) The U.S. Army Defense Ammunition Center and School (USADACS), Validation Engineering Division (SMCAC-DEV), was tasked by the Office of the Project Manager, Ammunition Logistics (PM-AMMOLOG) to test the Load and Roll Pallet (LRP) for shipment of Multiple Launch Rocket System (MLRS) pods and Army Tactical Missile System (ATACMS) restrained with softwood dunnage. The dunnage provides a mechanism to center the loaded LRP when it is loaded into a 20-foot end-opening container and provides blocking to prevent lateral pallet movement while in transit. Softwood is replacing the original hardwood blocking and bracing (see USADACS Report No. EVT 12-90) as a cost-saving measure and due to the lack of universal availability of hardwood. This test sequence consists of rail impact, road hazard, road, washboard, and shipboard transportation simulation. The end-opening container with the LRP loaded with MLRS pods passed all tests with the softwood dunnage. This report contains the results of the tests conducted.				
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22a. NAME OF RESPONSIBLE INDIVIDUAL JEROME H. KROHN			22b. TELEPHONE (Include Area Code) 815-273-8929	22c. OFFICE SYMBOL SMCAC-DEV

U.S. ARMY DEFENSE AMMUNITION CENTER AND SCHOOL
VALIDATION ENGINEERING DIVISION
SAVANNA, IL 61074-9639

REPORT NO. 93-07

MULTIPLE LAUNCH ROCKET SYSTEM (MLRS) ON LOAD AND ROLL PALLET (LRP)
WITH SOFTWOOD DUNNAGE TRANSPORTABILITY TESTS

TABLE OF CONTENTS

PART	PAGE NO.
1. INTRODUCTION	1-1
A. BACKGROUND	1-1
B. AUTHORITY	1-1
C. OBJECTIVE	1-1
D. CONCLUSION	1-1
E. RECOMMENDATION	1-2
2. ATTENDEES	2-1
3. TEST PROCEDURES	3-1
4. TEST RESULTS	4-1
5. PHOTOGRAPH	5-1
6. DRAWING	6-1

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Dist	Avail and/or Special
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PART 1

INTRODUCTION

A. BACKGROUND. The U.S. Army Defense Ammunition Center and School (USADACS), Validation Engineering Division (SMCAC-DEV), was previously tasked by the Office of the Project Manager, Ammunition Logistics (PM-AMMOLOG) to test the Load and Roll Pallet (LRP) for shipment of Multiple Launch Rocket System (MLRS) pods and Army Tactical Missile System (ATACMS) (see USADACS Report No. EVT 12-90). The loading procedures required hardwood dunnage at the front of the 20-foot end-opening container to ensure alignment of the LRP when loaded into the container. Since hardwood is not universally available at all ammunition loading sites, and the cost of hardwood makes it expensive to use, softwood was tested to determine if it is an acceptable replacement.

B. AUTHORITY. This test was conducted IAW mission responsibilities delegated by the U.S. Army Armament, Munitions and Chemical Command (AMCCOM), Rock Island, IL 61299-6000. Reference is made to Change 4, 4 October 1974, to AR-740-1, 23 April 1971, Storage and Supply Operations; AMCCOM-R 10-17, 13 January 1986, Mission and Major Functions of USADACS.

C. OBJECTIVE. The objective of these tests was to determine if softwood could be used to replace the hardwood dunnage used in shipping MLRS pods loaded on an LRP in a 20-foot end-opening container.

D. CONCLUSION. The intermodal shipping container safely retained the inert load of MLRS pods unitized on an LRP when subjected to the following tests: rail, road, and Shipboard Transportation Simulator (STS) tests.

E. **RECOMMENDATION.** The loading procedures for a unitized load of MLRS pods on an LRP shipped in a 20-foot end-opening container be approved for the transportation of MLRS pods with softwood dunnage.

PART 2

9-10 DECEMBER 1992

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PART 3

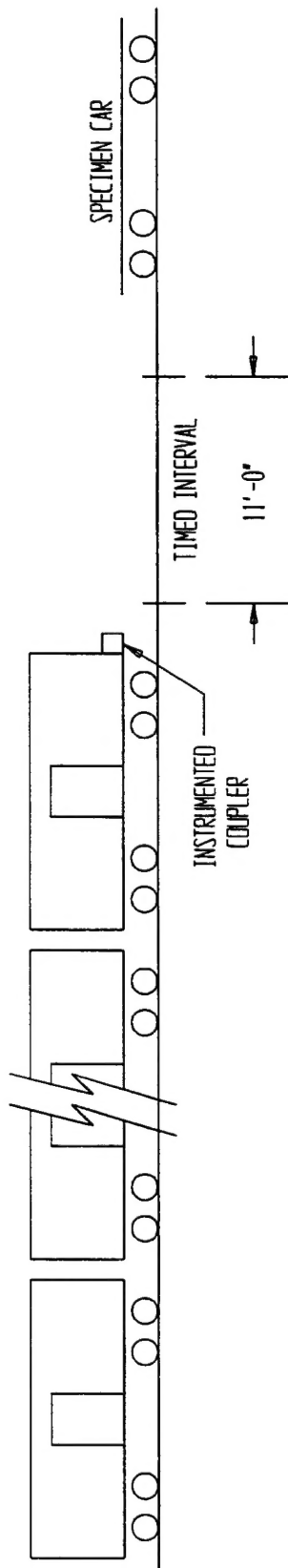
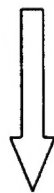
TEST PROCEDURES

A. RAIL IMPACT TEST. The test load or vehicle was positioned in/on a railcar. For containers, the loaded container was positioned on a container chassis and securely locked in place using the twist locks at each corner. The container chassis was secured to a railcar. Equipment needed to perform the test included the specimen (hammer) car, five empty railroad cars connected together to serve as the anvil, and a railroad locomotive. These anvil cars were positioned on a level section of track with air and hand brakes set and with the draft gear compressed. The locomotive unit pulled the specimen car several hundred yards away from the anvil cars, then pushed the specimen car toward the anvil at a predetermined speed, then disconnected from the specimen car approximately 50 yards away from the anvil cars, which allowed the specimen car to roll freely along the track until it struck the anvil. This constituted an impact. Impacting is accomplished at speeds of 4, 6, and 8.1 mph in one direction and at a speed of 8.1 mph in the reverse direction. The 4 and 6 mph impact speeds are approximate; the 8.1 mph speed is a minimum. Impact speeds were determined by using an electronic counter to measure the time required for the specimen car to traverse an 11-foot distance immediately prior to contact with the anvil cars.

B. ROAD HAZARD COURSE. Using a suitable truck/tractor or tactical vehicle, the vehicle/specimen of test method no. 1 was towed/driven over a hazard course two times at a speed of approximately 5 mph. The speed was increased or decreased, as appropriate, to produce the most violent load response.

C. ROAD TRIP. Using a suitable truck/tractor and trailer, or tactical vehicle, the tactical vehicle/specimen load was driven/towed for a total distance of at least 30 miles over a

ASSOCIATION OF AMERICAN RAILROADS (AAR) STANDARD TEST PLAN



SPECIMEN CAR
IS RELEASED BY
SWITCH ENGINE TO

ATTAIN: IMPACT NO. 1 @ 4 MPH
IMPACT NO. 2 @ 6 MPH
IMPACT NO. 3 @ 8.1 MPH

THEN THE CAR IS REVERSED AND
RELEASED BY SWITCH ENGINE TO

ATTAIN: IMPACT NO 4. @ 8.1 MPH

5 BUFFER CARS (ANVIL) WITH DRAFT GEAR
COMPRESSED AND AIR BRAKES IN A SET
POSITION

ANVIL CARS TOTAL WT 250,000 LBS (APPROX)

FIGURE 1

combination of roads surfaced with gravel, concrete, and asphalt. The test route included curves, corners, railroad crossings, cattle guards, and stops and starts. The test vehicle traveled at the maximum speed suitable for the particular road being traversed, except as limited by legal restrictions. This step provided for the tactical vehicle/specimen load to be subjected to three full air brake stops while traveling in the forward direction and one in the reverse direction. The first three stops were at 5, 10, and 15 mph, while the stop in the reverse direction was at approximately 5 mph.

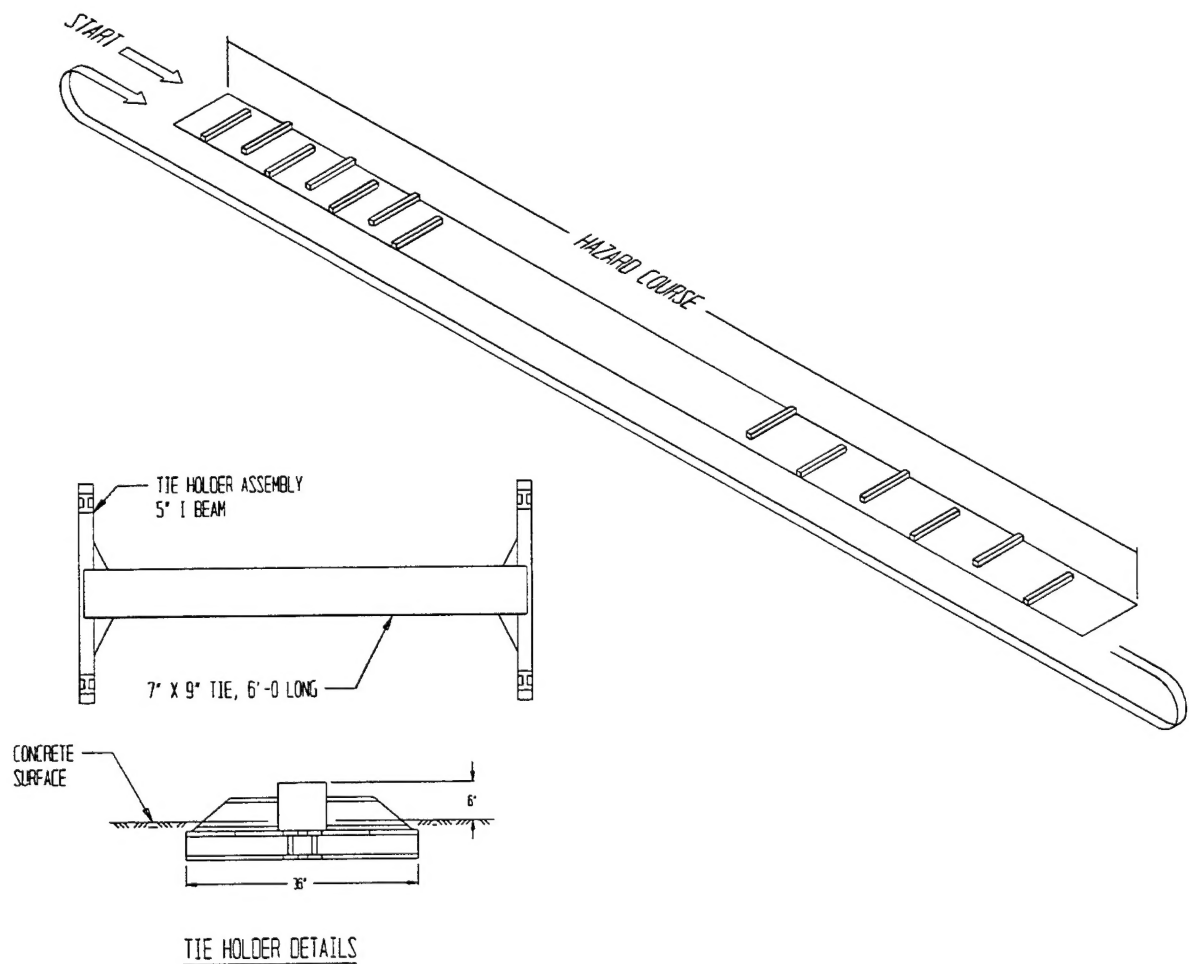


FIGURE 2

D. WASHBOARD COURSE. Using a suitable truck/tractor, and/or tactical vehicle, the specimen was towed/driven over the washboard course at a speed which produced the most violent response in the particular test load (as indicated by the resonant frequency of the suspension system beneath the load).

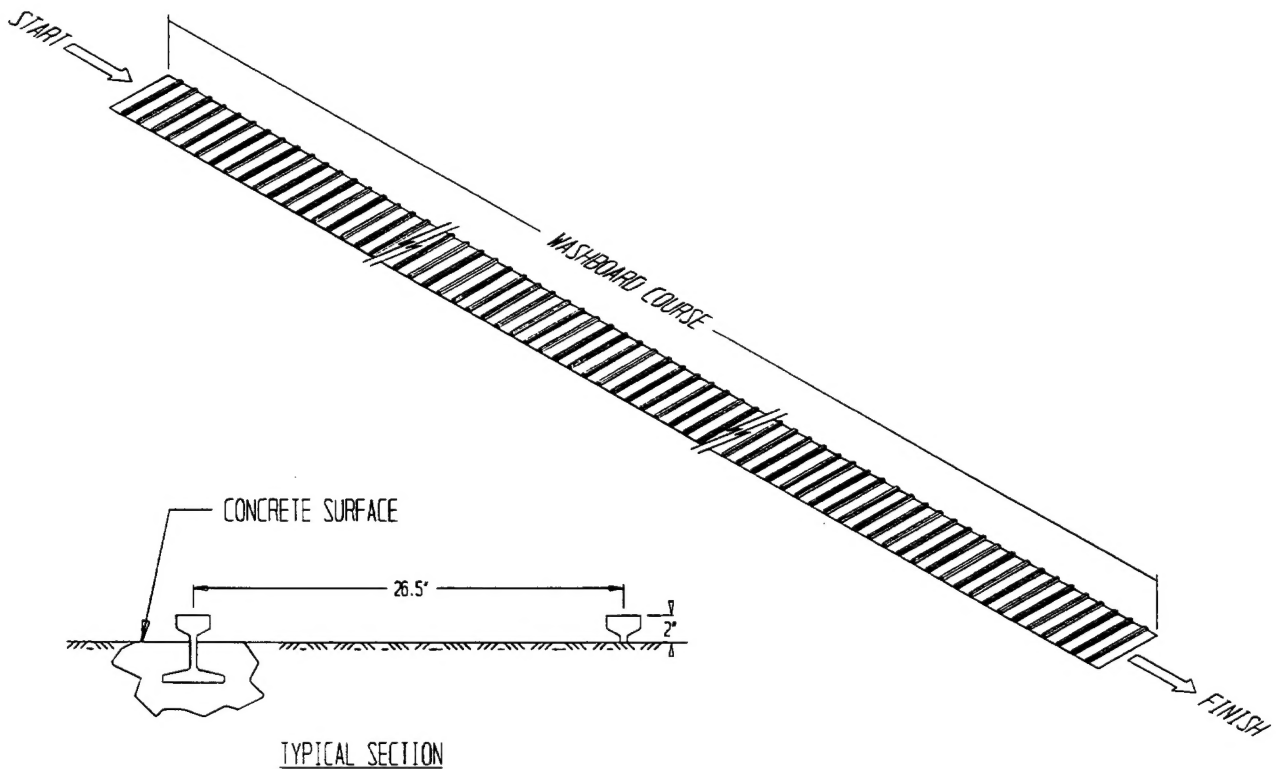


FIGURE 3

E. SHIPBOARD TRANSPORTATION SIMULATOR (STS). The test load (specimen) was positioned onto the STS and securely locked in place using the cam lock at each corner. Using the procedure detailed in the operating instructions, the STS started oscillating at an amplitude of 30 inches plus 2 inches, either side of center and a frequency of 2 cycles per minute (30 seconds plus 2 seconds total roll period). This frequency was maintained for 15 minutes during which time the load was observed for apparent defects that could cause a safety hazard.

The frequency of oscillation was increased to 4 cycles per minute (15 seconds + 1 second roll period) and the apparatus operated for 2 hours. Inspection of the load did not indicate an impending failure; therefore, the frequency of oscillation was further increased to 5 cycles per minute (12 seconds plus 1 second cycle time), and the apparatus operated for 4 hours. The operation does not necessarily have to be continuous; however, no change or adjustments to the load or load restraints were permitted at any time during the test. The test load (specimen) cannot be removed from the apparatus, after once being set in place, until the test has been completed or is terminated.

PART 4
TEST RESULTS

RAIL IMPACT DATA

TEST NO. 1

DATE: 9 December 1992

TEST SPECIMEN: MLRS pods on an LRP in a 20-foot end-opening container on a TOFC.

TEST CAR NO.: TTX 251297 LT. WT.: 74,900 pounds

CHASSIS NO.: 5394 LT. WT.: 6,040 pounds

CONTAINER NO.: USAG 0602172 LT. WT.: 5,048 pounds

LRP LT. WT.: 1,970 pounds

LADING AND DUNNAGE, MLRS (concrete filled) WT.: 21,800 pounds

TOTAL SPECIMEN WT.: 109,758 pounds

BUFFER CAR (5 CARS) WT.: 250,000 pounds

<u>IMPACT NO.</u>	<u>END STRUCK</u>	<u>VELOCITY (MPH)</u>	<u>REMARKS</u>
1	Rear	4.69	No movement.
2	Rear	6.30	No movement.
3	Rear	8.43	No movement.
4	Rear	8.62	No movement.

ROAD TEST DATA

TEST NO. 2

DATE: 10 December 1992

TEST SPECIMEN: MLRS pods on an LRP in a 20-foot end-opening container on a TOFC.

PASS 1-A OVER FIRST SERIES OF TIES: 5.67 SEC 6.02 MPH

PASS 1-B OVER SECOND SERIES OF TIES: 6.12 SEC 5.35 MPH

REMARKS: No movement of LRP or MLRS pods.

PASS 2-A OVER FIRST SERIES OF TIES: 6.13 SEC 5.56 MPH

PASS 2-B OVER SECOND SERIES OF TIES: 6.31 SEC 5.19 MPH

REMARKS: No movement of LRP or MLRS pods.

30 MILE ROAD TEST: No movement of LRP or MLRS pods.

PASS 3-A OVER FIRST SERIES OF TIES: 5.53 SEC 6.13 MPH

PASS 3-B OVER SECOND SERIES OF TIES: 6.17 SEC 5.53 MPH

REMARKS: No movement of LRP or MLRS pods.

PASS 4-A OVER FIRST SERIES OF TIES: 6.22 SEC 5.48 MPH

PASS 4-B OVER SECOND SERIES OF TIES: 6.18 SEC 5.30 MPH

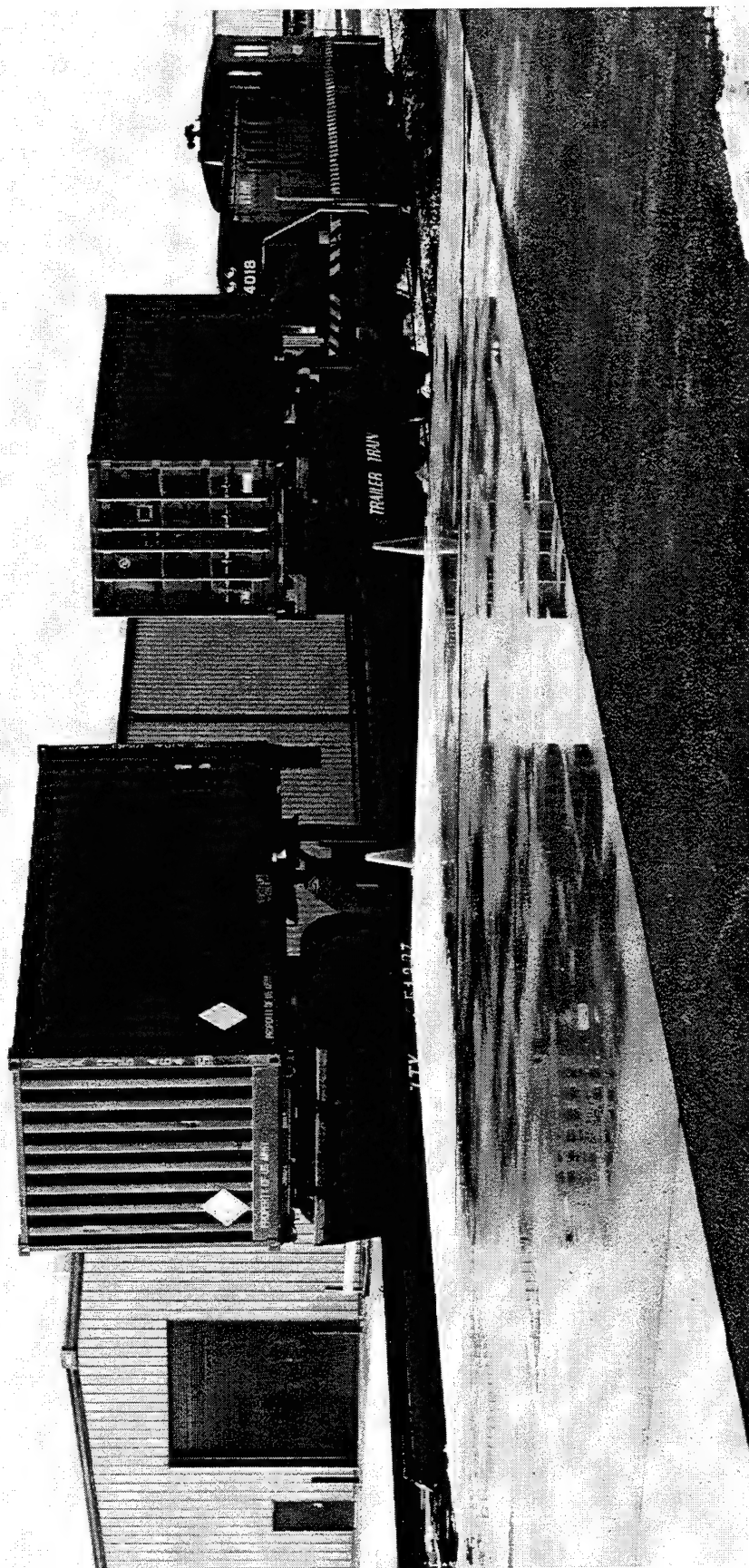
REMARKS: No movement of LRP or MLRS pods.

WASHBOARD COURSE: No physical damage to the LRP or MLRS pods.

SHIPBOARD TRANSPORTATION SIMULATOR (STS): No damage to the container, LRP, or MLRS pods.

PART 5

PHOTOGRAPH



U.S. ARMY DEFENSE AMMUNITION CENTER AND SCHOOL -
SAVANNA, IL

AO317-SCN93-48-538. This photo shows the 20-foot end-opening container on a TOFC containing a load of MLRS pods on an LRP. Softwood dunnage was used to restrain the LRP in the container. No damage occurred during testing.

PART 6

DRAWING

APPROVED BY
BUREAU OF EXPLOSIVES

D. Healy

DATE 1-4-95

MLRS

LOADING AND BRACING • WITH LOAD AND ROLL PALLET (LRP) • IN COMMERCIAL CONTAINERS OF ROCKET POD/CONTAINERS (RP/C) FOR MULTIPLE LAUNCH ROCKET SYSTEM, FOR SHIPMENT BY T/COFC CARRIER

INDEX

<u>ITEM</u>	<u>PAGE(S)</u>
GENERAL NOTES AND MATERIAL SPECIFICATIONS - - - - -	2
RP/C DETAIL AND SPECIAL HANDLING GUIDANCE - - - - -	3-5
FULL LOAD PROCEDURES (STEEL STRAPPING METHOD) - - - - -	6-7
FULL LOAD PROCEDURES (WEB STRAPPING METHOD) - - - - -	8-9
BLOCKING DETAILS - - - - -	10

- LOADING AND BRACING SPECIFICATIONS SET FORTH WITHIN THIS DRAWING ARE APPLICABLE TO LOADS THAT ARE TO BE SHIPPED BY TRAILER/CONTAINER-ON-FLATCAR (T/COFC) RAIL CARRIER SERVICE. THESE SPECIFICATIONS MAY ALSO BE USED FOR LOADS THAT ARE TO BE MOVED BY MOTOR OR WATER CARRIERS.

• SEE GENERAL NOTE
"P" ON PAGE 2.

U.S. ARMY MATERIEL COMMAND DRAWING

APPROVED, U.S. ARMY MISSILE COMMAND

DRAFTSMAN

TECHNICIAN

ENGINEER

R. HAYNES

G. WILLIS

VALIDATION
ENGINEERING
DIVISION

TRANSPORTATION
ENGINEERING
DIVISION

LOGISTICS
ENGINEERING
OFFICE

APPROVED BY ORDER OF COMMANDING GENERAL, U.S.
ARMY MATERIEL COMMAND

U.S. ARMY DEFENSE AMMUNITION CENTER AND SCHOOL

DECEMBER 1994

CLASS

DIVISION

DRAWING

FILE

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GM15RS3

DO NOT SCALE

PROJECT GM 820-89

GENERAL NOTES

- A. THIS DOCUMENT HAS BEEN PREPARED AND ISSUED IN ACCORDANCE WITH AR 740-1 AND AUGMENTS TM 743-200-1 (CHAPTER 5).
- B. THE SPECIFIED OUTLOADING PROCEDURES ARE APPLICABLE TO LOADS OF MULTIPLE LAUNCH ROCKET SYSTEM ROCKET POD/CONTAINERS (RP/C) UTILIZING A LOAD AND ROLL PALLET (LRP). SUBSEQUENT REFERENCE TO POD HEREIN MEANS THE RP/C WITH ROCKET COMPONENTS. NOTE: THE OUTLOADING PROCEDURES ARE ALSO APPLICABLE TO THE ARMY TACTICAL MISSILE SYSTEM (ATACMS) MISSILE LAUNCH POD ASSEMBLY (M/LPA) OR OTHER SIMILARLY CONFIGURED ITEMS NOT EXCEEDING 22,000 POUNDS IN TOTAL LADING WEIGHT.
- C. FOR DETAILS OF THE ROCKET POD/CONTAINER, SEE US ARMY MISSILE COMMAND DRAWING NO. 13027900.
- POD DIMENSIONS - - - 13'-10" LONG BY 41-1/2" WIDE BY 33" HIGH
GROSS WEIGHT - - - 5,078 POUNDS (APPROX)
- D. THE OUTLOADING PROCEDURES SPECIFIED HEREIN CAN ALSO BE UTILIZED FOR THE SHIPMENT OF THE DEPICTED PODS WHEN THEY ARE LOADED WITH AN ITEM WHICH IS IDENTIFIED DIFFERENTLY BY NOMENCLATURE THAN THE ITEM DESIGNATED IN THE DRAWING TITLE.
- E. THE LOAD AS SHOWN IS BASED ON A 4,700 POUND 20' LONG BY 8' WIDE BY 8'-6" HIGH END OPENING ISO CONTAINER WITH INSIDE DIMENSIONS OF 19'-4" LONG BY 92" WIDE BY 95" HIGH (93" CLEAR HEIGHT) AND A MAXIMUM GROSS WEIGHT OF 52,910 POUNDS. THE LOAD IS DESIGNED FOR TRAILER/CONTAINER-ON-FLATCAR (T/COFC) SHIPMENT, HOWEVER, THE LOAD AS DESIGNED CAN ALSO BE MOVED BY OTHER SURFACE MODES OF TRANSPORT. NOTICE: OTHER CONTAINERS OF THE SAME DESIGN CONFIGURATION CAN BE USED.

(CONTINUED AT RIGHT)

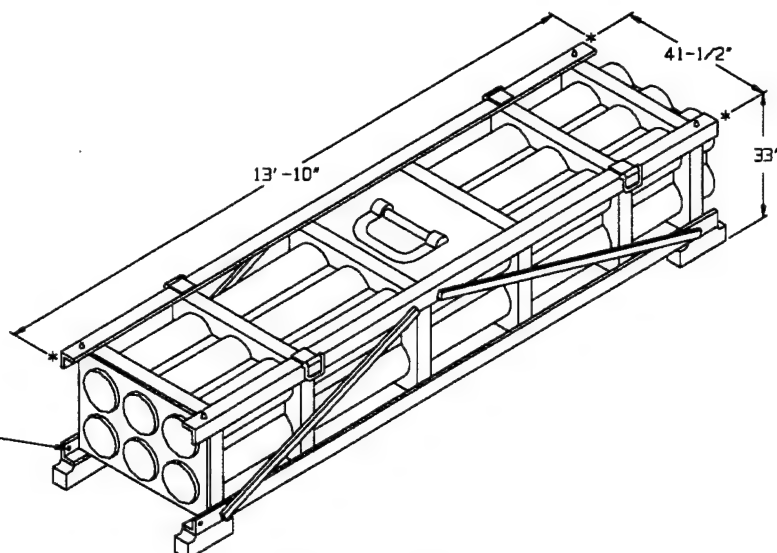
MATERIAL SPECIFICATIONS

- LUMBER - - - - - : SEE TM 743-200-1 (DUNNAGE LUMBER) AND FED SPEC MM-L-751.
- NAILS - - - - - : FED SPEC FF-N-105; COMMON.
- STRAPPING, STEEL - - : ASTM D3953; FLAT STRAPPING, TYPE 1, HEAVY DUTY, FINISH A, B (GRADE 2), OR C.
- SEAL, STRAP - - - - : ASTM D3953; CLASS H, FINISH A, B (GRADE 2), OR C, DOUBLE NOTCH TYPE, STYLE I, II, OR IV.
- WEB STRAP - - - - - : ANCRU ASSEMBLY PART NO. 48050-10 (BM-30-24-260P3) OR EQUIVALENT.
- WIRE, CARBON STEEL - : ASTM A853; ANNEALED AT FINISH, BLACK OXIDE FINISH, .0800" DIA, GRADE 1006 OR BETTER.
- STAKE POCKET PROTECTOR - : COMMERCIAL GRADE.
- ANTI-CHAFING MATERIAL - - - - - : FED SPEC PPP-F-320, TYPE SF (SOLID FIBERBOARD), CLASS-DOMESTIC, ALL GRADES.
- LOAD AND ROLL PALLET - - - - - : LOAD & ROLL INC DRAWING NO. 100-3121 AND PATENT NO. 4,834,000. CAPACITY 22,000 POUNDS.
- LUMBER, LRP BLOCKING - - - : FED SPEC MM-L-751; DOUGLAS FIR OR COMPARABLE LUMBER WITH STRAIGHT GRAIN AND FREE FROM MATERIAL DEFECTS.
- PLYWOOD - - - - - : COMMERCIAL ITEM DESCRIPTION A-A-55057, TYPE A, CONSTRUCTION AND INDUSTRIAL PLYWOOD, INTERIOR WITH EXTERIOR GLUE, GRADE C-D. IF SPECIFIED GRADE IS NOT AVAILABLE, A BETTER INTERIOR OR AN EXTERIOR GRADE MAY BE SUBSTITUTED.

(GENERAL NOTES CONTINUED)

- F. WHEN LOADING THE PODS, THEY ARE TO BE POSITIONED SO AS TO ACHIEVE A TIGHT LOAD (TIGHT AGAINST THE FORWARD BLOCKING ASSEMBLY). ADDITIONALLY, LATERAL VOIDS WITHIN THE LOAD ARE TO BE HELD TO A MINIMUM. EXCESSIVE SLACK CAN BE ELIMINATED FROM A LOAD BY LAMINATING ADDITIONAL PIECES OF APPROPRIATE THICKNESS TO THE FILLER BLOCKS ON THE CORNER RETAINER PIECES. NAIL EACH ADDITIONAL PIECE TO THE FILLER BLOCK W/4 APPROPRIATELY SIZED NAILS. ADDITIONALLY, THE THICKNESS OF THE FILLER BLOCKS MAY BE ADJUSTED AS REQUIRED TO FACILITATE VARIANCE IN THE SIZE OF THE LOAD AND ROLL PALLET OR THE CONTAINER INTERIOR LOADING SPACE.
- G. DUNNAGE LUMBER SPECIFIED IS OF NOMINAL SIZE. FOR EXAMPLE, 1" X 4" MATERIAL IS ACTUALLY 3/4" THICK BY 3-1/2" WIDE AND 2" X 6" MATERIAL IS ACTUALLY 1-1/2" THICK BY 5-1/2" WIDE.
- H. WHEN STEEL STRAPPING IS SEALED AT AN END-OVER-END LAP JOINT, A MINIMUM OF ONE SEAL WITH TWO PAIR OF NOTCHES WILL BE USED TO SEAL THE JOINT WHEN A NOTCH-TYPE SEALER IS BEING USED. A MINIMUM OF TWO SEALS, BUTTED TOGETHER WITH TWO PAIR OF CRIMPS PER SEAL WILL BE USED TO SEAL THE JOINT WHEN A CRIMP-TYPE SEALER IS BEING USED. REFER TO THE "STRAP JOINT A" AND "STRAP JOINT B" DETAILS ON PAGE 5 FOR GUIDANCE.
- J. DIMENSIONS GIVEN FOR DUNNAGE PIECES OR ASSEMBLIES WILL BE FIELD CHECKED PRIOR TO THEIR ASSEMBLY AND INSTALLATION INTO THE END OPENING CONTAINER.
- K. MAXIMUM LOAD WEIGHT CRITERIA:
- THE MAXIMUM LOAD WEIGHTS ARE CONTROLLED BY EQUIPMENT CAPABILITY FACTORS. ALTHOUGH THE HEAVIEST MAXIMUM LOADS ARE DELINEATED IN THE LOAD VIEWS, PROVISIONS ARE INCLUDED WITHIN THIS DRAWING SO THAT THE BASIC LOADS CAN BE ADJUSTED TO SATISFY A LESSER QUANTITY OF LADING UNITS. DEPENDING ON TRANSPORTATION ROUTING, IT MAY BE NECESSARY TO REDUCE THE LOAD WEIGHT TO SATISFY "WEIGHT LAWS" OF CERTAIN STATES. ALSO, IT MAY BE NECESSARY TO REDUCE THE LOAD WEIGHT TO SATISFY OTHER WEIGHT RESTRICTIONS IMPOSED ON THE INTERMODAL CONTAINER SYSTEM.
- L. REQUIREMENTS CITED WITHIN THE BUREAU OF EXPLOSIVES PAMPHLET 6C APPLY WHEN THE SHIPMENT MOVES BY TRAILER/CONTAINER-ON-FLATCAR (T/COFC). SPECIAL T/COFC NOTES FOLLOW:
1. A LOADED CONTAINER MUST BE ON A CHASSIS EQUIPPED WITH TWO BOGIE ASSEMBLIES WHEN BEING MOVED IN TOFC SERVICE.
 2. THE LOAD LIMIT OF A T/COFC RAILCAR MUST NOT BE EXCEEDED, NOR WILL A CAR BE LOADED SO THAT THE TRUCK UNDER ONE END OF THE CAR CARRIES MORE THAN ONE-HALF OF THE LOAD LIMIT FOR THAT CAR.
- M. DURING INTRASTATE AND/OR INTERSTATE MOVES BY MOTOR CARRIER, A PROPER CHASSIS OR MODIFIED FLATBED TRAILER MUST BE USED TO PRECLUDE VIOLATION OF ONE OR MORE "WEIGHT LAWS" APPLICABLE TO THE STATE OR STATES INVOLVED.
- N. THREE INCH (3") WIDE WEB CARGO STRAPS MAY BE USED IN LIEU OF THE 2" WIDE STEEL HOLD-DOWN STRAPS USED TO SECURE THE LADING TO THE LOAD AND ROLL PALLET. EACH WEB CARGO STRAP ASSEMBLY MUST HAVE A MINIMUM LOAD RATING OF 9,000 POUNDS AND CONSIST OF A HEAVY CAPACITY RATCHET, 3-INCH WIDE POLYESTER WEBBING, A PAIR OF MOVABLE CORNER PROTECTORS, A FLAT HOOK ON EACH END, AND A KEEPER ON EACH FLAT HOOK. AN ACCEPTABLE WEB STRAP ASSEMBLY IS IDENTIFIED IN THE MATERIAL SPECIFICATIONS BELOW.
- O. CONVERSION TO METRIC EQUIVALENTS: DIMENSIONS WITHIN THIS DOCUMENT ARE EXPRESSED IN INCHES AND WEIGHTS ARE EXPRESSED IN POUNDS. WHEN NECESSARY, THE METRIC EQUIVALENTS MAY BE COMPUTED ON THE BASIS OF ONE INCH EQUALS 25.4 MM AND ONE POUND EQUALS 0.454 KG.
- P. THE LOAD AND ROLL PALLET IS A COMMERCIAL PRODUCT. FOR A SOURCE OF SUPPLY, CONTACT LOAD AND ROLL INC., 10100 KITTY AVENUE, CHICAGO RIDGE, IL 60415. PHONE (708) 499-3370.
- Q. PORTIONS OF THE CONTAINER DEPICTED WITHIN THIS DRAWING, SUCH AS THE SIDEWALL, HAVE NOT BEEN SHOWN IN THE LOAD VIEWS FOR CLARITY PURPOSES.

INDICATES DRAGGING FACILITY HOLE IN
RP/C FRAME (LOCATED ON AFT END ONLY).



ROCKET POD/CONTAINER

SPECIAL HANDLING GUIDANCE

1. POD STACKING FOR OUTLOADING PURPOSES.

- A. THE UPPER POD SHOULD BE PLACED AS CLOSELY AS POSSIBLE IN VERTICAL ALIGNMENT WITH THE LOWER POD.
- B. WHEN STACKING THESE PODS, CARE MUST BE EXERCISED TO INSURE THAT THE INTERLOCKING HOLES IN THE BOTTOM OF THE POD SKIDS ALIGN CORRECTLY WITH THE INTERLOCKING PINS ON THE TOP OF THE POD FRAME. THIS WILL PRECLUDE DAMAGE TO THE SKIDS AND INSURE PROPER FUNCTIONING OF THE POD INTERLOCKS.

2. POD OR POD STACK HANDLING.

NOTES: (1) MATERIALS HANDLING EQUIPMENT (MHE) IS INTENDED TO MEAN EQUIPMENT, SUCH AS FORKLIFT TRUCKS, CRANES, HAND TRUCKS, DOLLIES, ROLLER ASSEMBLIES, SLINGS, AND SPREADER BARS, THAT CAN BE USED TO HANDLE THE DEPICTED PODS.

(2) PRECAUTIONARY HANDLING TECHNIQUES NORMALLY EMPLOYED OR AS SPECIFIED FOR THE TYPE OF COMMODITY INVOLVED WILL BE OBSERVED.

- A. ONLY APPROVED AND APPROPRIATELY SIZED MHE WILL BE USED FOR HANDLING THE DEPICTED PODS.
- B. IF HANDLING IS ACCOMPLISHED WITH A FORKLIFT TRUCK, THE PODS SHOULD BE HANDLED FROM A SIDE POSITION ONLY. CARE MUST BE EXERCISED WHEN INSERTING THE FORKS UNDER THE POD TO PREVENT DAMAGE TO THE PODS BY THE FORK TINES OR THE FORKLIFT PACKAGE GUARD. ADDITIONALLY, THE FORK TINES SHOULD BE PLACED UNDER THE PODS STRONG AREAS; THAT IS, THE LATERAL FRAME MEMBERS/BULKHEADS LOCATED NEAR THE LONGITUDINAL CENTER OF THE POD.

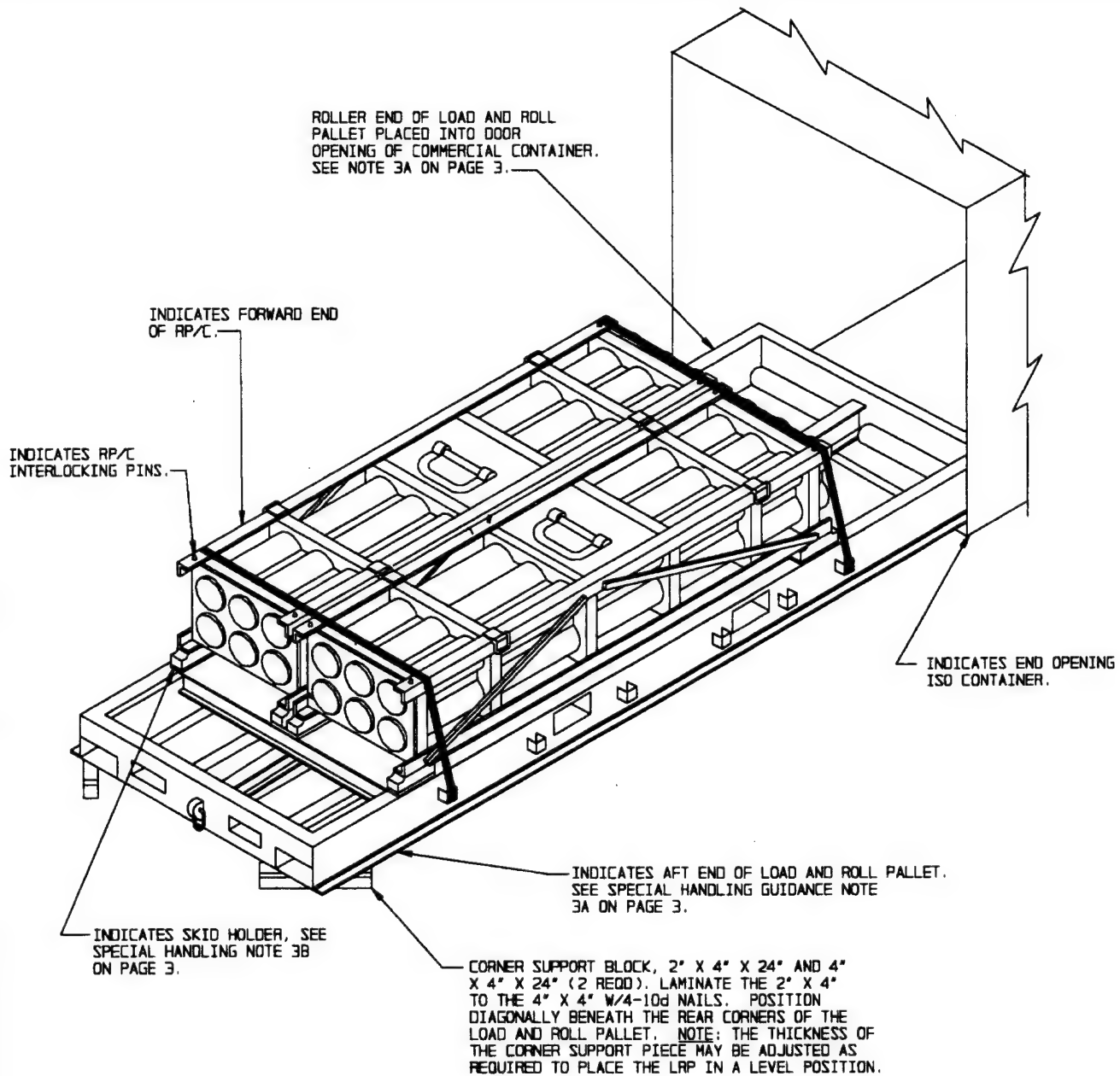
3. SEQUENTIAL CONTAINER LOADING.

- A. NOTE: FOR EASE IN LOADING THE LOAD AND ROLL PALLET INTO THE END OPENING CONTAINER, SET THE FRONT END PORTION (APPROX 24") OF THE LOAD AND ROLL PALLET IN THE OPEN DOORWAY END OF THE END OPENING CONTAINER AND INSERT CORNER SUPPORTS DIAGONALLY BENEATH THE REAR CORNERS OF THE LOAD AND ROLL PALLET (SEE THE DETAIL ON PAGE 4).

(CONTINUED AT RIGHT)

(SPECIAL HANDLING GUIDANCE CONTINUED)

- B. LOAD THE PODS OR POD STACKS BY FIRST INSERTING THE FAR SKIDS IN THE CENTER SKID RESTRAINT PANS ON THE LOAD AND ROLL PALLET. THEN LOWERING THE NEAR SKIDS INTO THE OUTSIDE SKID RESTRAINT PANS ON THE PALLET.
NOTE: THE AFT END OF THE PODS MUST BE POSITIONED AT THE FORWARD END OF THE LOAD AND ROLL PALLET.
 - C. APPLY THE STACK UNITIZING STRAP. NOTE: FIBERBOARD ANTI-CHAFING MATERIAL MUST BE INSTALLED UNDER THE STRAPS AT ALL POINTS OF CONTACT WITH THE PODS.
 - D. INSTALL THE CENTER FILL PIECES. POSITION THE CENTER FILL PIECES OF THE BOTTOM LAYER SO THAT THEY ARE SUPPORTED BY THE TOP OF THE FORK POCKET (TUNNEL) ON THE LOAD AND ROLL PALLET. POSITION THE CENTER FILL PIECES FOR THE TOP LAYER IN LINE WITH THOSE FOR THE BOTTOM LAYER. WIRE TIE THE CENTER FILL PIECES TO THE POD FRAME.
 - E. NEXT, LOAD AND UNITIZE THE REMAINING PODS IN THE MANNER DETAILED IN PARAGRAPHS 3B AND 3C ABOVE.
 - F. APPLY THE HOLD-DOWN STRAPS, POSITIONING FIBERBOARD ANTI-CHAFING MATERIAL UNDER THE STRAPS AT ALL POINTS OF CONTACT WITH THE PODS. CAUTION: THE HOLD-DOWN STRAPS MUST BE INSTALLED WITH CARE SO AS NOT TO HAVE EDGE-TO-EDGE CONTACT WITH THE STACK UNITIZING STRAPS.
 - G. POSITION THE FORWARD BLOCKING ASSEMBLY IN THE END OPENING CONTAINER. LIFT THE REAR END OF THE LOAD AND ROLL PALLET WITH APPROPRIATELY SIZED MHE UNTIL ONLY THE ROLLER CONTACTS THE END OPENING CONTAINER FLOOR (REF: 6"). ROLL THE PALLET INTO THE CONTAINER UNTIL IT CONTACTS THE FORWARD BLOCKING ASSEMBLY. SET THE REAR OF THE PALLET ON THE END OPENING CONTAINER FLOOR. INSTALL THE CORNER RETAINER PIECES AND FILL MATERIAL AS NECESSARY.
- ### 4. UNLOADING THE LOAD AND ROLL PALLET FROM THE END OPENING CONTAINER.
- A. THE LOAD AND ROLL PALLET MAY BE UNLOADED USING THE REVERSE OF THE METHOD DETAILED IN 3G ABOVE.
 - B. THE LOAD AND ROLL PALLET MAY ALSO BE UNLOADED USING A VEHICLE WITH AN APPROPRIATELY SIZED WINCH. FIRST, REMOVE THE CORNER RETAINER PIECES. ATTACH THE WINCH TO THE D-RING ON THE REAR OF THE LOAD AND ROLL PALLET, RAISE THE PALLET UNTIL THE ROLLER CONTACTS THE END OPENING CONTAINER FLOOR, AND PULL THE PALLET OUT USING THE WINCHING VEHICLE, TAKING CARE NOT TO PULL THE PALLET TOTALLY OUT OF THE END OPENING CONTAINER. SET CORNER SUPPORTS UNDER THE CORNERS OF THE PALLET, AND UNLOAD THE MLRS PODS, USING APPROPRIATELY SIZED MHE.



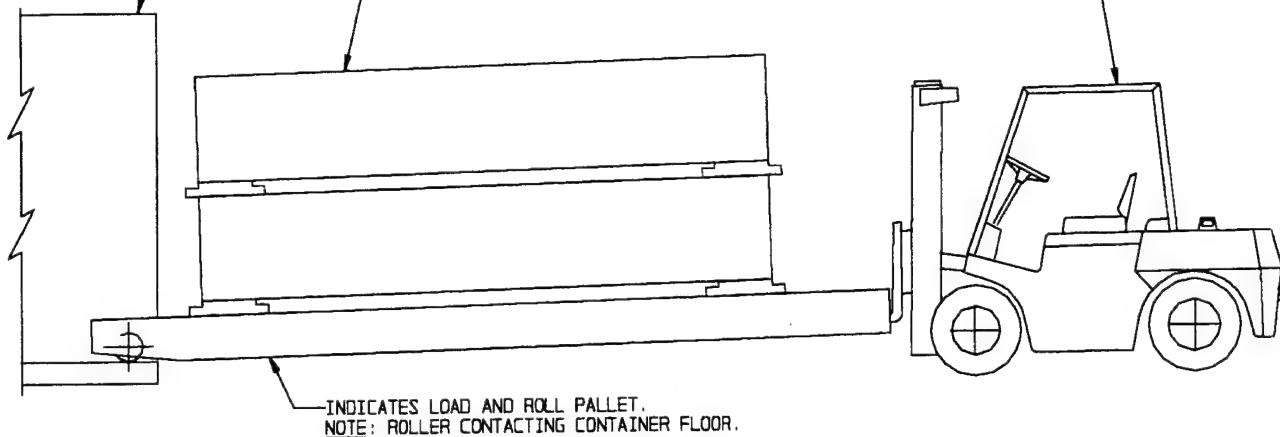
ISOMETRIC VIEW

ALTHOUGH THE ABOVE VIEW DEPICTS ONLY TWO PODS SECURED TO A LOAD AND ROLL PALLET, THE SAME PROCEDURES ARE APPLICABLE FOR A FOUR POD LOAD.

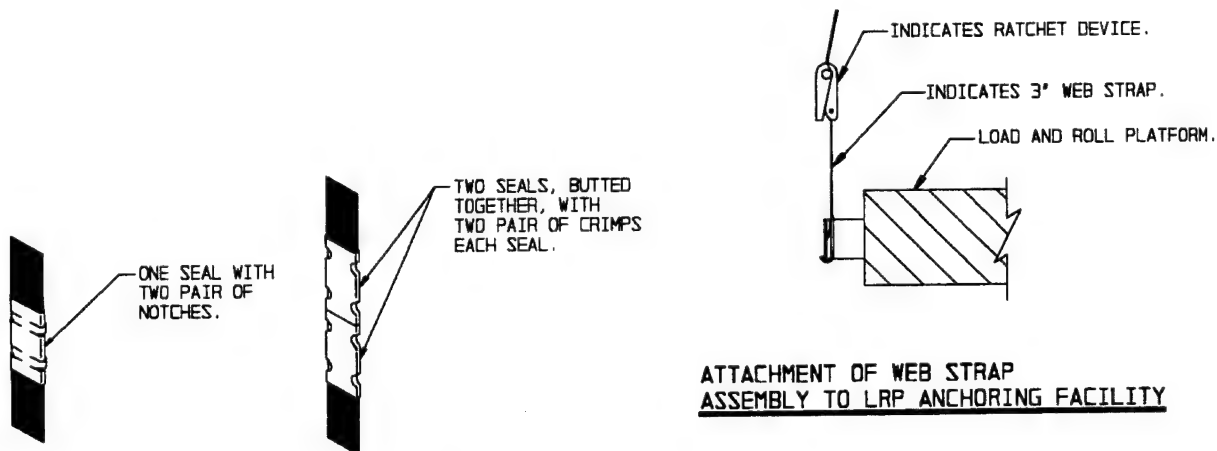
INDICATES END OPENING
ISO CONTAINER.

INDICATES ROCKET POD/CONTAINERS
SECURED TO LOAD AND ROLL PALLET.

INDICATES FORKLIFT TRUCK
(OR PAIR OF FORK-LIFT
TRUCKS SIDE BY SIDE).



LOADING OF LRP AND MLRS CONTAINERS INTO END OPENING ISO CONTAINER

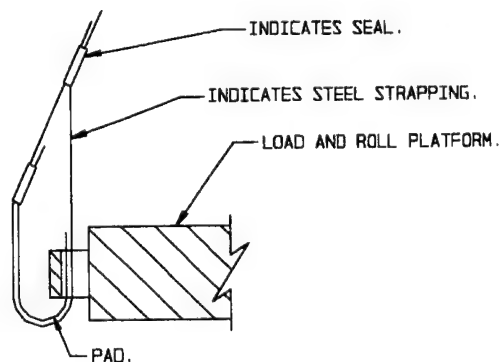


ATTACHMENT OF WEB STRAP ASSEMBLY TO LRP ANCHORING FACILITY

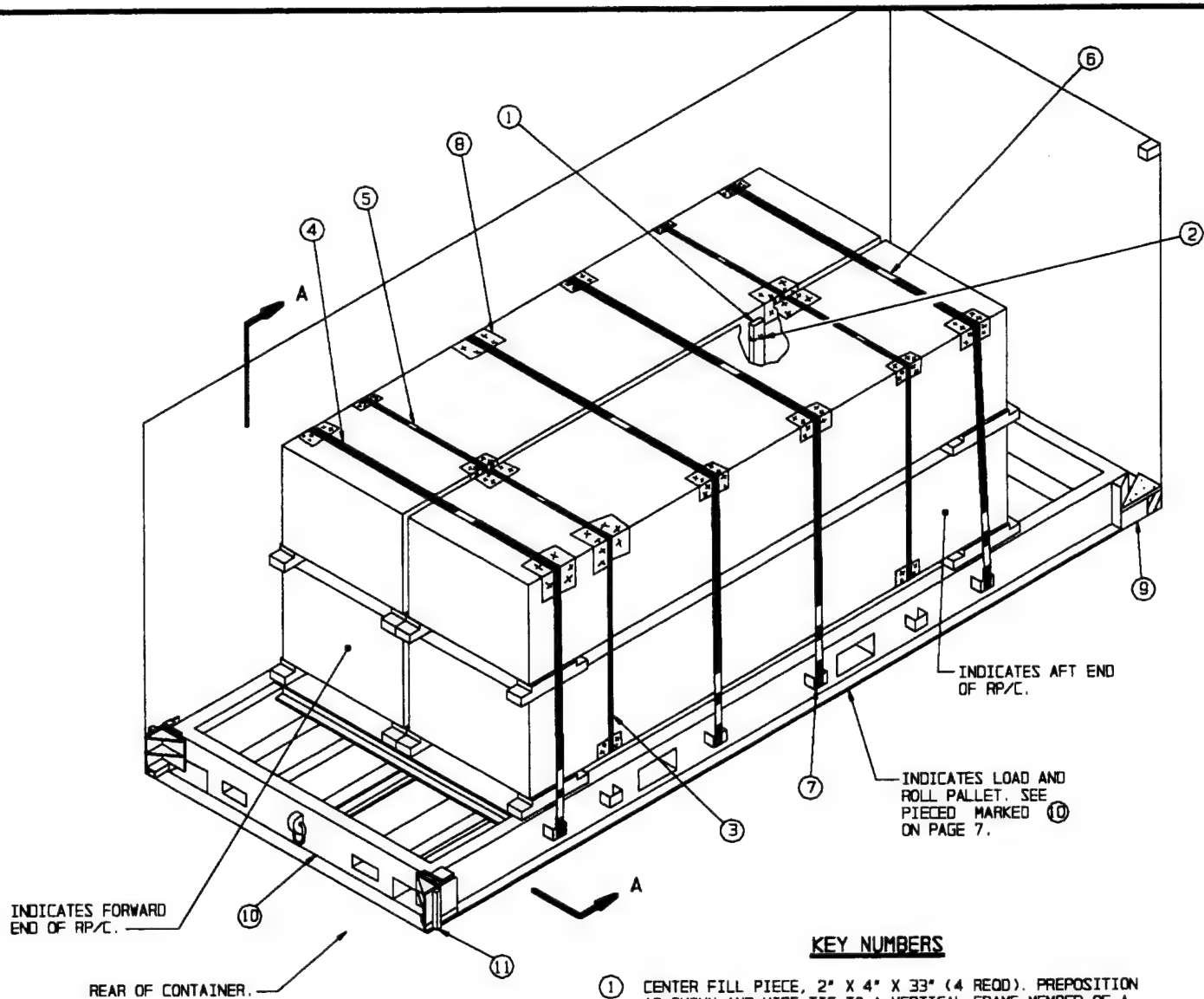
STRAP JOINT A
METHOD OF SECURING A
STRAP JOINT WHEN USING
A NOTCH-TYPE SEALER.

STRAP JOINT B
METHOD OF SECURING A
STRAP JOINT WHEN USING
A CRIMP-TYPE SEALER.

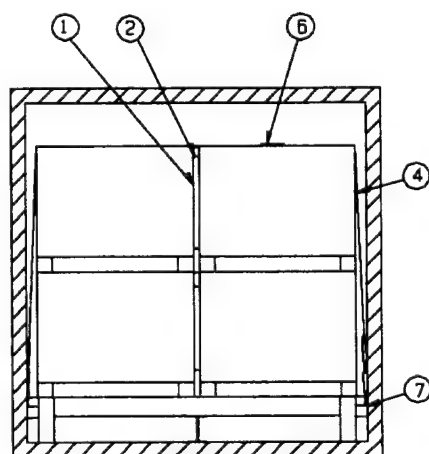
END-OVER-END LAP JOINT DETAILS



ATTACHMENT OF STEEL STRAPPING TO LRP ANCHORING FACILITY



ISOMETRIC VIEW



SECTION A-A

KEY NUMBERS

- ① CENTER FILL PIECE, 2" X 4" X 33" (4 REQD). PREPOSITION AS SHOWN AND WIRE TIE TO A VERTICAL FRAME MEMBER OF A ROCKET POD/CONTAINER. SEE NOTE 3D ON PAGE 3.
- ② TIE WIRE, NO. 14 GAGE WIRE, 24" LONG (8 REQD). INSTALL WIRE TO FORM A LOOP AROUND A VERTICAL FRAME MEMBER OF A POD AND THE CENTER FILL PIECE, PIECE MARKED ①. BRING ENDS TOGETHER AND TWIST TAUT.
- ③ STACK UNITIZING STRAP, 1-1/4" X .035" OR .031" BY A LENGTH TO SUIT (REF: 20'-0") (4 REQD). INSTALL SO AS TO ENCIRCLE THE CONTAINERS IN ONE STACK AS SHOWN.
- ④ HOLD-DOWN STRAP, 2" X .050" OR .044" X 28'-0" LONG STEEL STRAPPING (4 REQD). INSTALL EACH STRAP FROM TWO 14'-0" LONG PIECES.
- ⑤ SEAL FOR 1-1/4" STEEL STRAPPING (4 REQD, 1 PER STRAP). CRIMP EACH SEAL WITH TWO PAIR OF NOTCHES. SEE GENERAL NOTE "H" ON PAGE 2.
- ⑥ SEAL FOR 2" STEEL STRAPPING (20 REQD, 5 PER STRAP). CRIMP EACH STRAP WITH TWO PAIR OF NOTCHES, EXCEPT FOR THOSE USED TO SECURE THE PADS, WHICH ONLY REQUIRE ONE PAIR OF NOTCHES. SEE GENERAL NOTE "H" ON PAGE 2.
- ⑦ PAD, STRAPPING, 2" X .050" OR .044" X 24" (8 REQD). PRE-POSITION THE PAD BETWEEN THE STRAPPING, PIECE MARKED ④, AND THE LOAD AND ROLL PALLET TIEDOWN PROVISION AND SECURE WITH ONE SEAL WITH ONE PAIR OF NOTCHES. SEE THE "ATTACHMENT OF STEEL STRAPPING TO LRP ANCHORING FACILITY" DETAIL ON PAGE 5.
- ⑧ FIBERBOARD ANTI-CHAFING MATERIAL (AS REQD). FOLD FIBERBOARD TO FORM A DOUBLE THICKNESS AND PLACE UNDER STRAPPING AT ALL POINTS OF CONTACT WITH THE CONTAINERS.

(CONTINUED ON PAGE 7)

- ⑨ FORWARD BLOCKING ASSEMBLY (1 REQD). SEE THE DETAIL ON PAGE 10. PRE-POSITION PRIOR TO LOADING THE LOAD AND ROLL PALLET IN THE CONTAINER.
- ⑩ LOAD AND ROLL PALLET (1 REQD). SEE THE "SPECIAL HANDLING GUIDANCE" ON PAGES 4 AND 5. SEE GENERAL NOTE "P" ON PAGE 2.
- ⑪ CORNER RETAINER PIECE (2 REQD). SEE THE DETAIL ON PAGE 10. SEE GENERAL NOTE "F" ON PAGE 2.

SPECIAL NOTES:

1. A 4-UNIT LOAD OF ROCKET POD/CONTAINERS (RP/C) IS DEPICTED ON A LOAD AND ROLL PALLET IN AN END OPENING ISO CONTAINER.
2. PRIOR TO LOADING THE PODS INTO THE END OPENING CONTAINER, SEE THE SPECIAL HANDLING GUIDANCE ON PAGES 3 AND 4.
3. ALL STRAPS MUST BE INSTALLED NEAR THE STRONG POINTS OR VERTICALLY REINFORCED AREAS OF THE PODS.

BILL OF MATERIAL

LUMBER	LINEAR FEET	BOARD FEET
2" X 4"	11	8
4" X 4" *	11	15
NAILS	NO. REQD	POUNDS
6d (2")	14	NIL
10d (3")	4	NIL
STEEL STRAPPING, 2" - - - - 128' REQD - - - - 43 LBS		
SEAL FOR 2" STRAPPING - - - - 20 REQD - - - - 5 LBS		
STEEL STRAPPING, 1-1/4" - - - 80' REQD - - - - 11 LBS		
SEAL FOR 1-1/4" STRAPPING - - - 4 REQD - - - - 1/4 LB		
WIRE, NO. 14 GAGE - - - - 16' REQD - - - - NIL		
PLYWOOD, AS REQD - - - - 2 SQ FT REQD - - - - NIL		
ANTI-CHAFING MATERIAL - - - - AS REQD - - - - NIL		
LOAD AND ROLL PALLET - - - - 1 REQD - - - 1,970 LBS		

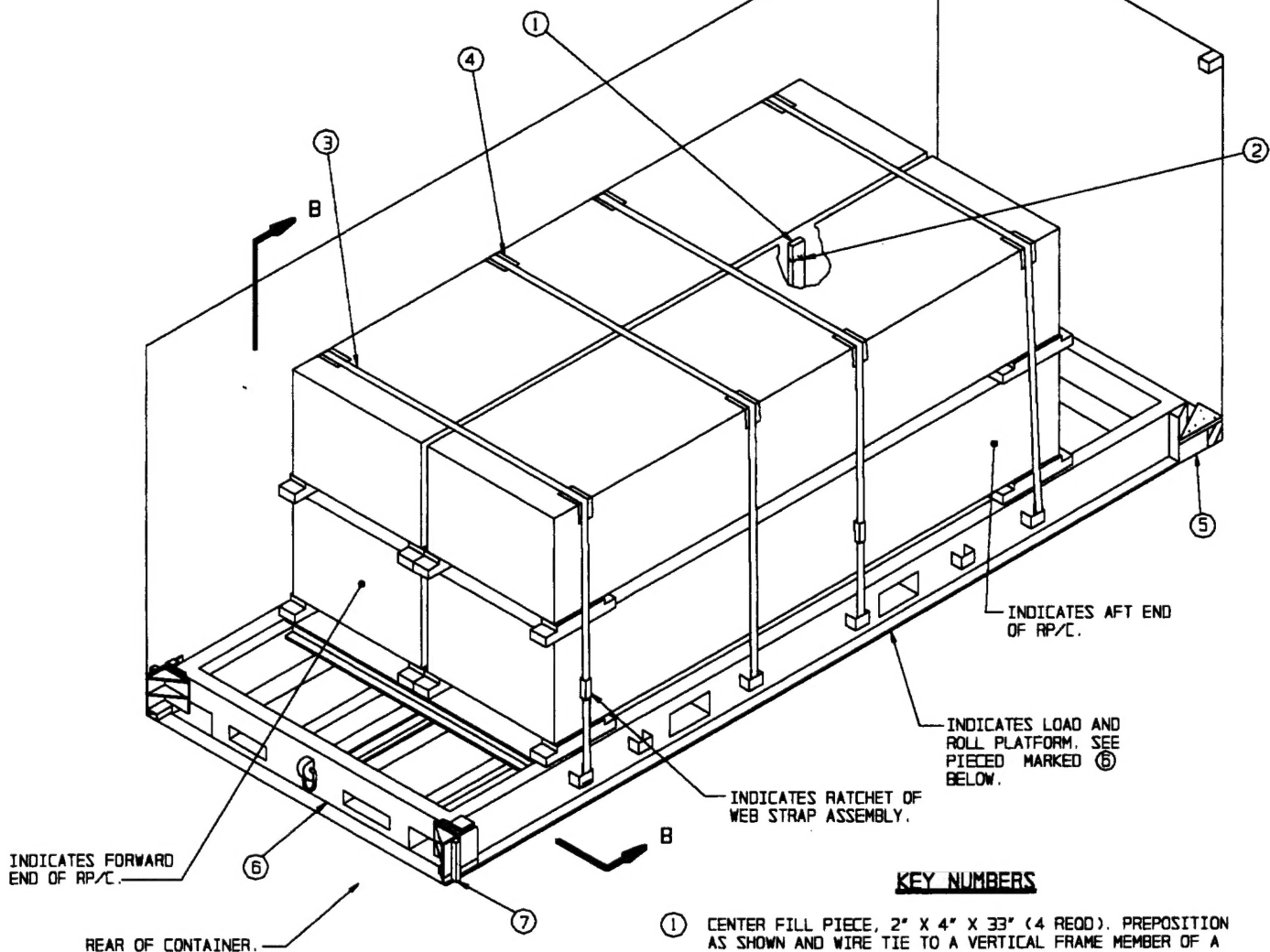
* THE 4" X 4" MATERIAL SHOULD MEET THE REQUIREMENTS SET FORTH IN THE MATERIAL SPECIFICATIONS FOR LUMBER, LRP BLOCKING.

LOAD AS SHOWN

ITEM	QUANTITY	WEIGHT (APPROX)
MLRS (RP/C) - - - - -	4 - - - - -	20,312 LBS
DUNNAGE - - - - -	- - - - -	2,076 LBS
END OPENING CONTAINER - - - - -	- - - - -	4,700 LBS

TOTAL WEIGHT - - - - - 27,088 LBS (APPROX)

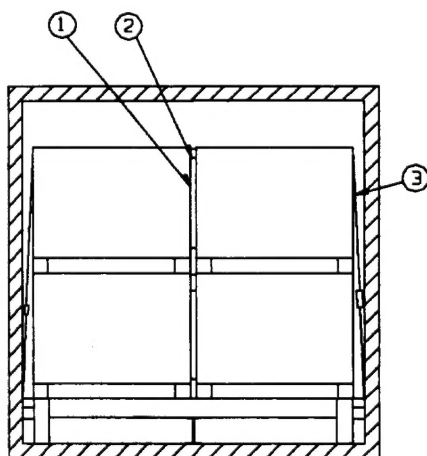
FULL LOAD PROCEDURES (STEEL STRAPPING METHOD)



ISOMETRIC VIEW

KEY NUMBERS

- ① CENTER FILL PIECE, 2" X 4" X 33" (4 REQD). PREPOSITION AS SHOWN AND WIRE TIE TO A VERTICAL FRAME MEMBER OF A ROCKET POD/CONTAINER. SEE NOTE 3D ON PAGE 3.
- ② TIE WIRE, NO. 14 GAGE WIRE, 24" LONG (8 REQD). INSTALL WIRE TO FORM A LOOP AROUND A VERTICAL FRAME MEMBER OF A POD AND THE CENTER FILL PIECE, PIECE MARKED ①. BRING ENDS TOGETHER AND TWIST TAUT.
- ③ WEB STRAP TIEDOWN ASSEMBLY (4 REQD). INSTALL TO EXTEND FROM AN ANCHORING FACILITY ON ONE SIDE OF THE LOAD AND ROLL PALLET, OVER THE POD STACKS, TO AN ANCHORING FACILITY ON THE OPPOSITE SIDE OF THE PALLET. SEE GENERAL NOTE "N" ON PAGE 2. SEE THE "ATTACHMENT OF WEB STRAP ASSEMBLY TO LRP ANCHORING FACILITY" DETAIL ON PAGE 5.
- ④ CORNER PROTECTOR (2 PER STRAP PROVIDED). POSITION ON OUTER EDGE OF THE POD FRAME. NOTE: IF THE CORNER PROTECTOR IS MISSING THEN A FOLDED PIECE OF FIBERBOARD SHALL BE USED TO PROTECT THE WEBBING.
- ⑤ FORWARD BLOCKING ASSEMBLY (1 REQD). SEE THE DETAIL ON PAGE 10. PRE-POSITION PRIOR TO LOADING THE LOAD AND ROLL PALLET IN THE CONTAINER.
- ⑥ LOAD AND ROLL PALLET (1 REQD). SEE THE "SPECIAL HANDLING GUIDANCE" ON PAGES 4 AND 5. SEE GENERAL NOTE "P" ON PAGE 2.
- ⑦ CORNER RETAINER PIECE (2 REQD). SEE THE DETAIL ON PAGE 10. SEE GENERAL NOTE "F" ON PAGE 2.



SECTION B-B

SPECIAL NOTES:

1. A 4-UNIT LOAD OF ROCKET POD/CONTAINERS (RP/C) IS DEPICTED SECURED WITH WEB STRAPPING TO A LOAD AND ROLL PALLET AND LOADED INTO AN END OPENING ISO CONTAINER.
2. PRIOR TO LOADING THE ROCKET POD/CONTAINERS INTO THE END OPENING CONTAINER, SEE THE SPECIAL HANDLING GUIDANCE ON PAGES 3 AND 4. HOWEVER, WEB CARGO STRAPS AS DESCRIBED IN GENERAL NOTE "N" ON PAGE 2 WILL BE USED IN LIEU OF THE 1-1/4" WIDE STEEL STACK UNITIZING STRAPS AND THE 2" WIDE STEEL HOLD-DOWN STRAPS DEPICTED ON PAGES 3 AND 4.
3. ALL STRAPS MUST BE INSTALLED NEAR THE STRONG POINTS OR VERTICALLY REINFORCED AREAS OF THE PODS.

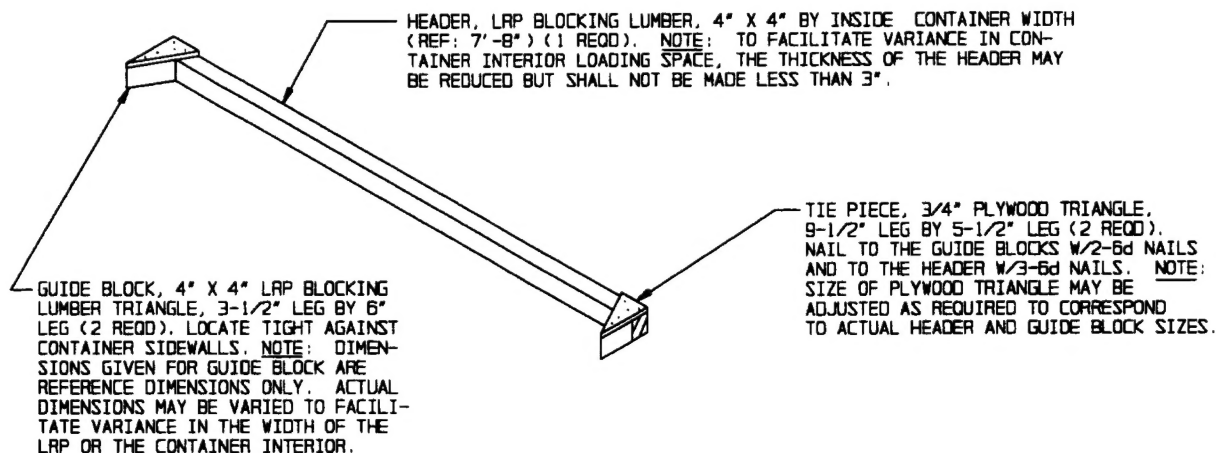
BILL OF MATERIAL		
LUMBER	LINEAR FEET	BOARD FEET
2" X 4"	11	8
4" X 4" *	11	15
NAILS	NO. REQD	POUNDS
6d (2")	14	NIL
10d (3")	4	NIL
WEB STRAP ASSEMBLY (3") --- 4 REQD --- 44 LBS		
WIRE, NO. 14 GAGE --- 16' REQD --- NIL		
PLYWOOD, AS REQD --- 2 SQ FT REQD --- NIL		
ANTI-CHAFING MATERIAL --- AS REQD --- NIL		
LOAD AND ROLL PALLET --- 1 REQD --- 1,970 LBS		

* THE 4" X 4" MATERIAL SHOULD MEET THE REQUIREMENTS SET FORTH IN THE MATERIAL SPECIFICATIONS FOR LUMBER, LRP BLOCKING.

LOAD AS SHOWN

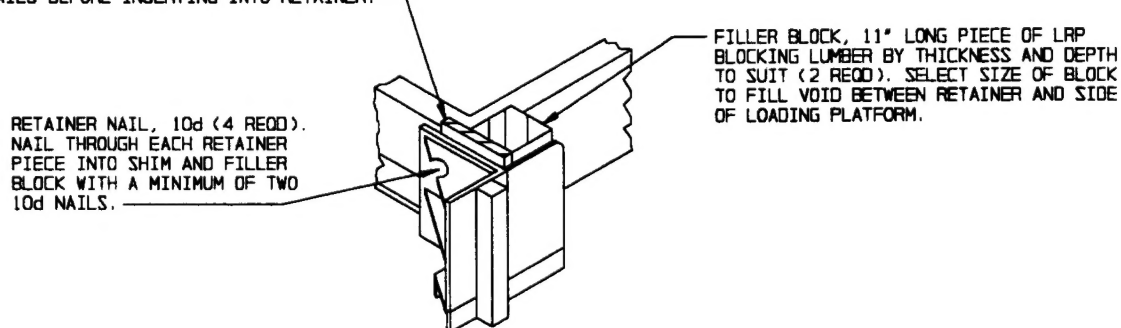
ITEM	QUANTITY	WEIGHT (APPROX)
MLRS (RP/C) - - - - -	4 - - - - -	20,312 LBS
DUNNAGE - - - - -	- - - - -	2,060 LBS
END OPENING CONTAINER - - - - -	- - - - -	4,700 LBS

TOTAL WEIGHT - - - - - 27,072 LBS (APPROX)



FORWARD BLOCKING ASSEMBLY

SHIM, 6" X 11" PLYWOOD BY THICKNESS TO SUIT (AS REQD). SELECT THICKNESS OF PLYWOOD TO FILL VOID BETWEEN FACE OF RETAINER AND END OF LOADING PLATFORM. NAIL PLYWOOD TO FILLER BLOCK W/2-6d NAILS BEFORE INSERTING INTO RETAINER.



CORNER RETAINER PIECE

NOTE: POSITION SQUARE BAR OF RETAINER PIECE INTO RECESS OF SIDEWALL LOCATED JUST AHEAD OF REAR CORNER POST.